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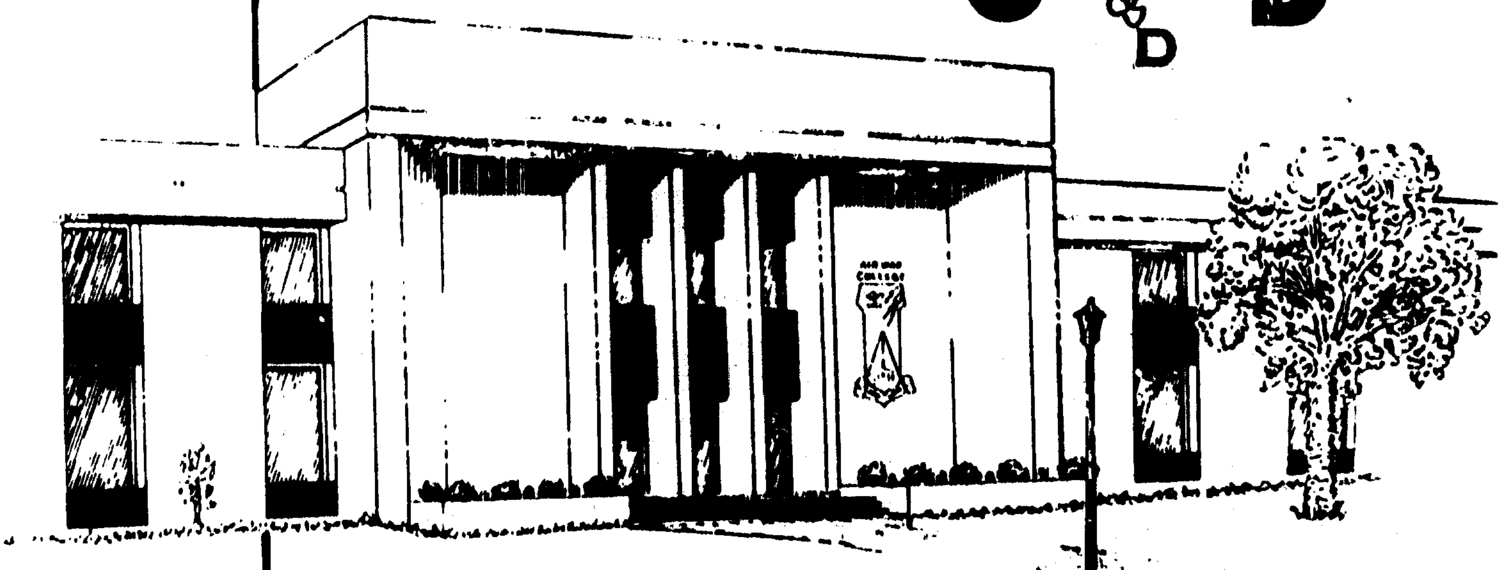
REVITALIZING CONTINENTAL AIR DEFENSE
FOR THE STRATEGIC ENVIRONMENT OF THE 1990S

By LIEUTENANT COLONEL MICHAEL J. INGELIDO II



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UNITED STATES AIR FORCE
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REVITALIZING CONTINENTAL AIR DEFENSE FOR THE STRATEGIC ENVIRONMENT OF THE 1990S

by

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A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE RESEARCH

REQUIREMENT

Research Advisor: Colonel George W. Tiller

MAXWELL AIR FORCE BASE, ALABAMA

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AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: Revitalizing Continental Air Defense for the Strategic Environment of the 1990s.

AUTHOR: Michael J. Ingelido II, Lieutenant Colonel, USAF

Advocates the need to revitalize the capability to defend North America from air attack based on the changing strategic environment. After examining Reexamines the relationship between continental air defense (CAD) and U.S. national defense strategy, Reviews the rationale for the decay of atmospheric defense since the 1960s. Outlines the deficiencies of the current and projected ~~the~~ air defense network, ~~and~~ matches the capabilities of the Soviet strategic air threat with potential scenarios for its employment against the CONUS, Articulates the interrelationship between the Strategic Defense Initiative (SDI) and CAD. Addresses the implications of other technological breakthroughs such as the Air Defense Initiative (ADI) on the strategic balance, and the impact of arms control agreements on strategic defense. ~~Outlines~~ recommendations for the long and short term revitalization of CAD.

BIOGRAPHICAL SKETCH

Lieutenant Colonel Michael J. Ingelido II (B.S., The Virginia Military Institute; M.S., The University of Southern California) has been involved with aerospace defense throughout his career. He gained air defense experience while serving as an F4 Weapon Systems Officer in fighter squadrons with interceptor missions in Iceland and Germany. He also has space defense experience with assignments as an satellite orbital analyst in the NORAD Cheyenne Mountain Complex (NCMC), and as a space surveillance officer in a missile warning squadron which was an element of the 440L over-the-horizon radar system. During his previous assignment to Colorado Springs he served three years in the Space Defense Operations Center inside the NCMC, and two years as Chief of the Fighter Operations Inspection Branch on the NORAD IG Team. Lieutenant Colonel Ingelido is a graduate of the Air War College, class of 1988.

AUTHOR'S PREFACE

This research report was written as a result of my experiences as a member of the North American Aerospace Defense Command's (NORAD) Inspector General Team. I was frustrated and concerned by the decay I saw in this nation's ability to defend itself from air attack. For all intent and purpose, the highly capable, integrated air defense network which once provided defense for North America now exists in name only. The small cadre of dedicated U.S. and Canadian personnel who remain, strive mightily to provide what modicum of capability they can from a system which is decimated and antiquated.

As a student at the Air War College, I was provided with a special opportunity to investigate the issue of continental air defense (CAD) in detail, while also examining my own motivation and biases on this subject. Were my concerns legitimate, or was I being blinded by my own experience and prejudice? Aware that I might be advocating a mission whose time had passed, I sought to validate my perceptions.

This paper is the outcome of that examination. Fully aware that another shallow and parochial report advocating the importance of air defense will not advance its case, I wanted to present a logical and objective rationale for revitalizing it. However, even if the reader

is not persuaded by my logic, I earnestly hope that he will still gain some greater insight into the issues involved and a better understanding of the risks the U.S. assumes by not taking timely action to provide a viable defense against the Soviet strategic air threat.

I wish to express my special thanks to my faculty advisor, Col. George Tiller, and a fellow classmate Col. Bob Frady, for their review and suggestions for improving this report. Finally, and most importantly, I want to thank my wife and children for their support throughout my Air Force career. Whatever service I may have been able to render during my career has been due in no small part to the the sacrifices they, like many other Air Force families, have had to make.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION AND BACKGROUND

Overview

During the past quarter century no element of American military power has been allowed to erode as precipitously and as dramatically as the ability to defend the United States from air attack. The reasons for this decline are many, varied, and at the time they were made, appeared rational based on the strategic environment as it then existed. However, neither time nor the global strategic environment have stood still since the decisions on this issue were made. The purpose of this paper is to examine the strategic environment of today and the remainder of the late Twentieth Century to resolve one issue: Does the United States need an effective defense against air attack, and if so, what should to be done to regain that capability?

This paper is divided into two parts. The first section will present the case for CAD and the reasons it remains an essential element of U.S. military power, and why its importance may grow substantially in the future. This section will examine the following areas: the interrelationship between CAD and U.S. national security; the deficiencies of the current and near term CAD network; the capabilities of the Soviet Union to conduct strategic air

operations against the continental United States (CONUS), and their military doctrine for the employment of those capabilities; the impact and implications of technological advances, such as the Air Defense Initiative (ADI) and the Strategic Defense Initiative (SDI), on CAD; and finally, the impact of diplomatic efforts such as the arms control negotiations on CAD. The second part of the paper will present recommendations for both the long and the short term to revitalize CAD and restore it as a credible element of America's defense within the context of limited defense funding and other competing priorities.

Limitations

The reader should understand one important point before continuing. The paper focuses almost exclusively on the importance of CAD to the United States, and what actions the U.S. must take to revitalize it. In no way is this meant to diminish the importance of the Canadian government and armed forces to the CAD of North America. The participation of our northern neighbor has been, and hopefully will remain, fundamental to the strategic defense of our two countries. Nevertheless, the paper concentrates on issues related primarily to the United States because that is the audience for which it is intended.

History

Before considering the body of the paper, the reader should have some appreciation of the history and background of CAD. An understanding of how CAD evolved to its present state will facilitate comprehension of the issues and problems which must be addressed and resolved if CAD is to be revitalized.

When the Air Force was created as a separate service in 1947, air defense of the CONUS was considered such a fundamental mission that the forces designated for it, the Air Defense Command, was one of the three original major commands in the USAF. However, for historic and institutional reasons, the leaders of the Air Force were not enthusiastic supporters of either the mission or the command. The USAF had no significant historical experience in large scale, integrated air defense operations, such as the Royal Air Force or the Luftwaffe had in World War II. Furthermore, the leadership of the new service, as disciples of "airpower", had made their case for a independent service based on their belief in the primacy of the offensive. Since the 1920s and the theories of Billy Mitchell and Douhet, the adherents of airpower had advocated the concept of strategic aerial bombardment. This was fundamental to the argument for an independent Air Force because it was a unique mission which no other service could perform. Furthermore, they believed offensive forces provided a more ef-

fective way of protecting the United States from attack. General Spaatz, the Chief of Staff of the USAF in 1947, succinctly stated their position,

> Defense against air attack is difficult...the surest defense will be our ability to strike back quickly with a counteroffensive, to neutralize the hostile attack at its source, or to discourage its continuance by striking at the vitals of the aggressor. (27:2)

In short, the best defense was a good offense. To build and operate a CONUS air defense network would require the USAF to acknowledge, and indeed to advocate, that a defense against the strategic bomber was possible. Most Air Force leaders were understandably reluctant to support a position seemingly so incompatible with their basic tenets.

Despite this lack of enthusiasm for the mission, actions by the USSR soon created sufficient concern by the U.S. government that the USAF was forced to reconsider its position, and pursue the capabilities to conduct an effective air defense of the CONUS. In 1949 the Soviets detonated their first atomic device, well before U.S. experts predicted they would achieve this capability. The Soviets also appeared to be building a strategic bomber force based on the TU-4 (NATO Codename BULL), a Soviet copy of the B-29.

This combination of weapon and delivery system changed the strategic equation between the two superpowers. The U.S. could not afford to appear vulnerable to atomic at-

tacks on its cities. Consequently, by the mid 1950s the U.S. began deployment of an integrated and automated air defense network designed to counter multiple mass raids by Soviet strategic bombers by providing defense in depth. (12:9) By the late 1950s this network reached its zenith when it consisted of some 2600 manned interceptors, 68 control centers, 286 radar sites, U.S. Army antiaircraft artillery (AAA) and surface-to-air missiles (SAMs) along with U.S. Navy radar picket ships guarding the coastal approaches to the CONUS. (9:2)

However, in 1957, the Soviets successfully launched their first intercontinental ballistic missile (ICBM). This new weapon was about to revolutionize military strategy, and would remove the compelling need for America's air defense network. By the early 1960s it was apparent that the USSR was placing the bulk of their strategic nuclear forces in ballistic missiles. Despite intense effort, a credible, affordable defense against ballistic missiles was not technically feasible at that time. The fundamental tenets of the air power prophets had finally come to pass. A strategic offensive weapon now existed against which there was no defense. Ultimately, the theory of deterrence based solely on offensive retaliation was adopted, and the "raison d'etre" for air defense steadily dissolved. In 1975 Secretary of Defense Schlesinger summed up an arguement prevalent in the Department of Defense (DoD) for over ten years when he said,

"Since we cannot defend our cities against strategic missiles, there is nothing to be gained by trying to defend them against a relatively small force of Soviet bombers." (19:56) Naturally, funding and institutional support for CAD decayed, and by the late 1970s only 340 manned interceptors, 85 radars and no SAMs, AAA, or picket ships remained of the once formidable CAD network. (9:3) Indeed, in 1979 Air Defense Command was eliminated as a major command. Its air defense assets were transferred to the Tactical Air Command, and its space and missile warning assets were transferred to the Strategic Air Command (SAC). Although the North American Air Defense Command (NORAD) retained operational control of these forces, what remained was a skeleton force designed to: first, provide air raid warning to the National Command Authority and the nation's nuclear retaliatory forces; second, to limit damage from a small scale bomber attack by preventing Soviet bombers from having a "free ride" into the nation's heartland; and third, to control access to North American airspace. (12:3)

By the early 1980s however, CAD had declined so precipitously that it was not thought capable of accomplishing even this modest mission. The need to review it became overwhelming. The Air Defense Master Plan (ADMP) was submitted by the Air Force to the Department of Defense (DoD) in January of 1981. The emphasis of this proposal was to deter a bomber attack by developing a credible capability to

limit damage to critical command, control, and communications (C3) facilities and retaliatory forces by providing reliable and timely warning of such an attack. (12:9) Basically the ADMP proposed the replacement of antiquated air defense equipment with more capable and easier to maintain systems. These improvements included: replacement of the 1950's technology radar sites with state of the art radars; development and deployment of an "over-the-horizon backscatter" (OTH-B) radar system to cover the coastal approaches to North America, and to provide detection at far greater ranges than conventional radar; replacement of the interceptor force by newer fighters with "look down/shoot down" capability; and creation of "forward operating bases" (FOBs) for interceptors and AWACS aircraft in the Canadian and Alaskan Arctic regions to improve their ability to "defend in depth". (9:9) General Allen, Chief of Staff of the Air Force in 1982, said in support of the ADMP, " Modernization and the designated force concept (a small core of dedicated NORAD assigned forces augmented by CONUS based general purpose forces) - applied to AWACS and air defense fighters - are the keys to improving active North American air defenses within prudent fiscal limits." (12:20) The costs estimated to implement the ADMP, part of which would be borne by the Canadian government, was estimated at eight billion dollars spent over approximately ten years. (2:34)

In summary then, despite Air Force philosophical re-

luctance, the United States built a highly capable air defense network in the 1950s to protect itself from the nuclear threat posed by the Soviet bomber force. With the emergence of the ICBM the bomber threat receded, and with no defense against ballistic missiles available, the U.S. adopted a strategy based solely on offensive retaliation. The air defense network was allowed to decay until the early 1980s when a modest modernization plan was undertaken.

The thesis of this paper is that the strategic environment has changed substantially since the ADMP was adopted in the early 1980s. The impact and implications of the Strategic Defense Initiative (SDI), political and diplomatic efforts to control and reduce nuclear weapons, the emergence of the cruise missile threat, and other technical advances are all urgent factors necessitating a careful reexamination of the nation's requirement for an effective air defense and for revitalization of CAD beyond the improvements agreed to in the ADMP. The chapters that follow examine these factors in detail.

CHAPTER II

REQUIREMENTS FOR CONTINENTAL AIR DEFENSE

Why is it necessary to be able to defend the CONUS from a strategic air attack, and how does such a capability fit into our national security policy? This chapter will examine U.S. military strategy and its relationship to CAD. The foundations for strategic defense, and particularly CAD, include national strategy, international agreements, and USAF doctrine.

National Objectives

At the national level, the requirement for CAD flows directly from the stated goals of our national security objectives. In 1987, President Reagan said, in his National Security Strategy document that, "The defense of North America is the Nation's most fundamental security concern." (43:13) The issue, of course, is how best to accomplish "the defense of North America"? Since the end of World War II, America's basic defense strategy has been based on the concept of deterrence. Through this strategy, we seek to convince our potential adversaries that the cost of aggression against the U.S. would far exceed any possible gain they might derive from such an act. (40:42) The backbone of America's deterrent strategy has been, and remains, the nation's nuclear retaliatory forces, often referred to as

"the Triad". These forces are composed of intercontinental ballistic missiles (ICBMs), manned strategic bombers, and submarine launched ballistic missiles (SLBMs). CAD is an essential element of the nation's defense because it supports deterrence by contributing to the survivability of the nuclear retaliatory forces. CAD denies one element of Soviet strategic power from operating undetected and unopposed against the CONUS, and thus protects both the National Command Authority (NCA) and the strategic retaliatory forces from surprise attack. A potent CAD also reduces the effectiveness of such an attack by engaging and destroying some or all of the enemies attacking force before they can strike their assigned targets. In short, an air defense network contributes to deterrence by preventing a Soviet strategic planner from being certain he can conduct a successful surprise attack against the CONUS.

International Agreement

The United States also has an obligation to defend the CONUS from air attack as a result of the North American Air Defense Agreement (NORAD) signed in May 1958 by the United States and Canada. This international agreement has been renewed periodically since it was originally signed, with the 1986 Agreement being the most recent. The document establishes the following objectives for NORAD:

A. To assist each country to safeguard the sovereignty of its airspace.

B. To contribute to the deterrence of attack on North America by providing capabilities for aerospace surveillance, warning and characterization of aerospace attack, and defense against air attack.

C. Should deterrence fail, to insure an appropriate response against attack by providing for the effective use of the forces of the two countries available for air defense. (2:35)

Air Force Doctrine

Finally, the U.S. Air Force, while not institutionally fervent in its commitment to the concept of air defense, acknowledges the requirement for this mission in the most recent edition of Air Force Manual 1-1, Basic Aerospace Doctrine of the United States Air Force. The mission of "strategic aerospace defense" is defined as follows:

> Strategic aerospace defense objectives are to integrate aerospace warning, control, and intercept forces to detect, identify, intercept, and destroy enemy forces (in any medium) attacking our nation's war sustaining capabilities or will to fight. Our strategic aerospace defense forces provide warning and assessment of strategic attack to the National Command Authorities through an extensive network of warning sensors, both on the Earth's surface and throughout the aerospace. This Air Force mission enhances the survivability of strategic aerospace offensive forces and protects our key military, political, and economic power base. (14:3-2)

While the emphasis in this statement is on "warning and assessment" to ensure survivability of retaliatory forces, it also acknowledges the need for active defense.

The USAF also has clearly stated operational doctrine for air defense in Air Force Manual 2-16, Aerospace Defense Operations. Unfortunately, this document is over 20 years old, and its currency, or lack of it, speaks volumes about the relative unimportance of air defense within the USAF. Nevertheless, while dated by advances in technology over the past two decades, AFM 2-16 still contains some basic immutable guidelines for an air defense system which are just as valid today as they were in 1966. It states the mission of CAD forces is to defend the CONUS from aerospace attack, and to accomplish this mission these forces must be able to detect, identify, intercept and destroy hostile forces. It also outlines the characteristics an air defense network should possess to accomplish its mission, specifically: responsiveness; flexibility; survivability; reliability; and the ability to recover and recycle its forces. (15:4)

To summarize, CAD is a mission which is mandated because our national strategy of deterrence depends on it for warning and protection. We also have an international agreement with Canada which acknowledges the importance of maintaining the sovereignty of North American airspace, and denying access to that airspace by any potential enemy. USAF doctrine acknowledges the mission, and specifies the functions and characteristics of a system designed to accomplish it. Using these documents as a guideline, the

next chapters examine the strategic air threat posed by the Soviets, and the capability of our current and proposed CAD network to accomplish its assigned mission.

CHAPTER III

SOVIET STRATEGIC AIR THREAT

The threat posed by any adversary is a function of his capabilities and intentions. Military capabilities are relatively easy to quantify because we can, within the limits of our intelligence services, count the number of weapons an opponent possesses. Likewise, we can reasonably estimate the capabilities of his weapons by extrapolating their performance from their physical appearance and from evidence gathered while monitoring their operations. We also evaluate the skill of his military personnel by observing his peacetime operations, his exercises, and whenever possible, his combat operations. While by no means trivial, these are relatively straightforward exercises in conventional intelligence gathering. Conversely, accurate estimates of an adversary's intentions are much more difficult and therefore, less reliable. Unless one acquires his battle plans, the only estimates that can be made are based on historical precedent, evidence derived from the observing the enemy's exercises, and his writings on military doctrine in the open literature. This evidence is difficult to quantify, and its analysis, like beauty, is very much in the eye of the beholder. Estimating an enemy's intentions is an extremely subjective and imprecise art, not a science.

Ultimately a nation's strategy is largely dependent on its perception of the threat posed by another country. It is dependence on this perception of the other country's intentions which makes strategic decisions so difficult. Simply stated: what is the likelihood that an adversary will follow a certain course of action, and how severe will the consequences be if his intentions are misjudged? When reviewing this chapter, the reader should keep these questions in mind, and remember the fragile nature of the estimates made of an opponent's intentions.

Soviet Capabilities

Since the early 1950s, the Soviets have possessed the ability to strike the CONUS with nuclear weapons by using atmospheric vehicles. Up through the early 1980s, this consisted solely of manned strategic bombers which could either drop bombs or launch short range air-to-surface missiles (ASMs). Since then, the nature of these atmospheric vehicles has changed significantly with the introduction of cruise missiles that can be launched either from the air (ALCM) or from the sea (SLCM).

The Soviets have continued to modernize and produce manned strategic bombers for many of the same reasons that the United States does. They provide a flexible force which has utility in both theater and global warfare using either conventional or nuclear weapons. In peacetime the can be used to "project force" in regions where the Soviets may

choose to flex their military might. Manned bombers have unique characteristics which make then especially useful in deterring nuclear war. They can be launched and held on "airborne alert" to enhance their ability to survive should an adversary choose to launch a ballistic missile attack. They can be used as a show of force by flying to, and holding at, "fail-safe" points. And finally they can be used for post strike reconnaissance and re-attack after a nuclear exchange has occurred. (18:23) Soviet commitment to the manned bomber is evidenced by their continued production of the TU-95 (NATO Codename BEAR) in its latest variant, the Bear-H, as a cruise missile carrier. Likewise, they are developing, and are expected to place in production soon, a new intercontinental supersonic bomber (BLACKJACK) with capabilities expected to be similar to the USAF's B-1. (40:26) Recently, Soviet Colonel General Nikolai Chervov, the Chief of the Soviet General Staff's Arms Control Directorate stated that the USSR is prepared to shift to more bomber based nuclear weapons if the U.S. proceeds to deploy highly survivable mobile land-based ICBMs. (1:48) Clearly, the Soviets believe that the manned bomber continues to have value as a strategic weapon, and therefore the U.S. cannot discount them as threats to the CONUS.

The Soviet's development and deployment of cruise missiles has largely paralleled U.S. efforts. They have, in all likelihood, exploited through espionage or open technol-

ogy transfer our own development of this family of weapons. Once again, they are attractive to the Soviets for the same reasons they are attractive to us. They are relatively low cost weapons which by virtue of their internal guidance systems are extremely accurate. Their small size and ability to fly at low altitude makes them very difficult to detect, and even more difficult to destroy, after they have been launched. They complicate the difficulties of the defensive forces and they act as a hedge against any sudden technical breakthrough in ballistic missile defense, or anti-submarine warfare which would threaten the viability of those elements of their strategic nuclear forces. Most importantly, they provide some new and very attractive employment options in the event of either theater or global warfare at the conventional and nuclear level. (42:190-191) Conversely, as with all missile systems, and unlike manned bombers, they have little utility prior to the outbreak of hostilities. The Soviets have now deployed ALCMs (AS-15s) on their Bear-Hs and are expected to do the same on their Blackjacks. Likewise, SLCMs such as the SS-NX-21 and SS-NX-24 are expected to be deployed on Soviet submarines. (28:36-37) The SLCMs present an especially difficult challenge for CAD because defense against these vehicles will require cueing from, and coordination with, U.S. and Allied naval units monitoring and conducting ASW operations off both coasts and the Arctic.

Soviet Intentions

Determining Soviet intentions is admittedly a very subjective issue, but one which must be addressed. Estimating an opponent's intentions requires evaluating what he has done in the past, what he is doing now, and what he says he will do in the future. What the Soviets have done in the past, and what they are doing today, seem far more reliable indicators of their future intentions are than what they say they will do.

From the perspective of history there is ample evidence that the Soviets would not hesitate to employ their forces in a surprise attack once it became obvious to them that a war was inevitable. Twice during the Twentieth Century Russia has been subjected to surprise attacks by foreign powers. The Japanese attacked Port Arthur at the start of the Russo-Japanese War in 1904, and the Nazis invaded the Soviet Union in 1941. In both cases, at least initially, the invaders were able to secure a significant military advantage over the defenders by virtue of the element of surprise. Consequently, the Soviets have become ardent advocates of the use of surprise in military actions, and on at least two occasions in the last twenty years have demonstrated their skill at conducting such operations. Although the 1968 Warsaw Pact invasion of Czechoslovakia, and the Soviet invasion of Afganistan were both anticipated by Western

intelligence experts, both these operations achieved tactical surprise, and were and highly successful from a Soviet military perspective.

Similarly, the present military posture of the Soviet Union yields some insight to their intentions. For what possible reason would the Soviets continue to produce, modernize, and acquire new strategic atmospheric weapon systems if they did not have a plan for their use? (18:6) In the same vein, why are the Soviets increasing the number of training sorties flown by their Bear-H aircraft in simulated strike missions against North America if they do not intend to employ them in a similar fashion? It should be noted that the mission "profiles" for these flights are quite different from the intelligence gathering missions flown by other BEAR variants that are optimized for that function, or the routine deployments to Cuba.

Finally, while far less reliable, and greatly influenced by the biases of the analyst, a review of their military and strategic thought reveals some very interesting concepts on how they view war, and especially global nuclear war. According to recent statements from some of the most senior members of the Soviet hierarchy, the Soviets would seek to avoid a nuclear war if at all possible. However, if it became apparent that such a war were inevitable, then the USSR should strike first. Such a strike would be planned to achieve total surprise. The element of surprise being per-

haps the single most important factor in Soviet military thought. (17:3) The Soviets also believe that nuclear weapons are not fundamentally different from other weapons, even though admittedly far more lethal. Thus Soviet forces must be prepared to fight, survive, and win a war in which such weapons are employed. Likewise the Soviets do not believe a global nuclear war will be short, and instead expect a protracted conflict. They refer to a first strike followed by subsequent attacks rather than an all-out cataclysmic nuclear exchange. (17:48) Finally, it seems reasonable to assume that, if presented with the opportunity, the Soviets would prefer to conduct a direct confrontation with the U.S. in such a manner that by deft utilization of their military, political, and psychological powers they could force the U.S. to capitulate on the issue at hand, rather than retaliate. It is this potential for coercion, perhaps even more than military victory, which the U.S. invites by the absence of an effective CAD.

Potential Scenarios

Given the capabilities the Soviets presently possess, coupled with their views and intentions regarding global nuclear war, there are several potential scenarios which could make the use of strategic atmospheric weapons attractive for use against the U.S. These scenarios include: a precursor "decapitation" strike against critical command, control and communications (C3) nodes; post-strike recon-

naissance; and post-strike reattack of surviving retaliatory forces and the C3 network. Each of these scenarios will be discussed in further detail.

A precursor "decapitation" strike could be designed to take advantage of the characteristics of cruise missiles vis-a-vis the current CAD system. Specifically, cruise missiles launched from either aircraft or submarines could be used to destroy critical C3 nodes of America's retaliatory forces without being detected during launch or ingress to their targets. Such an attack, if properly timed to precede a mass missile raid, could be used to prevent, disrupt, or at least delay, the decision to commit U.S. retaliatory forces. Such a delay would leave these forces vulnerable to the incoming mass missile raid, and thus force them to "ride-out" a massive nuclear attack. The effectiveness of whatever retaliatory forces survived would be substantially reduced, and thus the subsequent damage and destruction to the Soviet Union would be similarly reduced.

A variation on this scenario would be for the cruise missile attack to be conducted without an associated mass missile raid following. In this case, the Soviets might communicate an ultimatum of some type threatening the launch of the follow on mass raid if the U.S. does not capitulate, or at least comply with Soviet demands. In this case the national decision maker would be confronted with a choice of accepting the relatively minor devastation already endured,

or risking the total devastation of the country by exposing it to the follow-on attack while knowing that its ability to retaliate had been diminished. In either variation it is the present inability of the CAD system to detect cruise missiles which is the foundation of these scenarios.

In the post nuclear attack scenarios, it is the inability of the CAD to survive in a wartime environment which would make the U.S. vulnerable. In an environment where no organized CAD existed, Soviet manned bombers could roam at will across the country seeking out and destroying whatever surviving retaliatory forces, or other significant targets. still existed. Again, the U.S. would be vulnerable to an ultimatum by the Soviets to accept their terms, or risk further destruction of whatever national assets still existed.

Admittedly, all nuclear war scenarios are difficult to accept. For most, if not all, Americans believe that the decision to initiate a nuclear war would not be a rational act. These scenarios may seen extreme, yet, who would have believed the scenario that initiated World War I? The issue really becomes not whether these scenarios are likely, but rather, can they be ruled out? (29:128) They would involve great risk to the Soviets, who are notoriously adverse to taking risk. Nevertheless, if driven to a life or death decision to preserve the Communist state, or if they believed a nuclear conflict was inevitable, such scenarios cannot be dismissed.

It is this combination of continuing modernization and acquisition of new capabilities by the USSR to strike the CONUS using atmospheric delivery systems, together with uncertainty about Soviet intentions, which exposes the U.S. and her allies to weaknesses heretofore not considered. It is these vulnerabilities which must be considered when determining the future role of CAD.

CHAPTER IV

CURRENT AND PROJECTED CAD DEFICIENCIES

Traditionally, an integrated air defense network is made up of three basic elements: a surveillance network; the weapon systems; and the command and control segment. The surveillance network, which can be ground, air, or even space based, detects and tracks intruders. The weapon systems, which may be manned interceptors, surface to air missiles (SAMs) or antiaircraft artillery (AAA) units, are responsible for negating or destroying attacking forces. The centralized command and control element directs the surveillance elements and weapon systems to insure that their capabilities are effectively and efficiently employed against the intruders. Using this traditional model, this chapter will examine and identify important deficiencies in both the current and the future CAD network as modified by the ADMP.

Organization

NORAD, the military organization responsible for CAD is a binational, U.S. and Canadian, command which is divided into three regions: the Alaskan NORAD Region (ANR); the Canadian NORAD Region (CNR); and the CONUS NORAD Region (CONUSNR). The CNR and CONUSNR are further subdivided into two and four sectors respectively. Each sector commander is responsible for the defense of his sector based on those el-

ements of the integrated air defense network he has allocated to him by his region commander. He exercises this command from his sector operations control center (SOCC). The region commander is responsible for the defense of his "area of responsibility" (AOR), and may move air defense assets between the sectors within his region as necessary to meet the requirements of the air battle. He exercises command from his region operations control center (ROCC). All three regions report operationally to CINCNORAD at his Command Post inside the NORAD Cheyenne Mountain Complex. The CINC may move forces between the regions in order to meet the changing air defense situation. He also is responsible for interfacing with the national authorities of both nations, and for requesting additional assets to support the NORAD mission from these national authorities.

Surveillance Network

Today's surveillance network consists of ground based radar sites and airborne platforms such as the E-3 AWACS aircraft. The modernization of the ground based radar segment is one of the major elements of the ADMP. The North Warning System (NWS) will replace two 1950's vintage radar systems, the Distant Early Warning (DEW) Line, and the Pinetree Line. The NWS will eventually consist of some 13 minimally manned Long Range Radar (LRR) sites and 39 unmanned Short Range Radar (SRR) sites located in a line across the northern frontier of Canada and its coasts.

(19:61) The NWS in combination with the Seek Igloo radar network in Alaska and the Joint Surveillance System (JSS) radars within the CONUS will make up the conventional ground based radar network for CAD. While this modernization is called for in the ADMP and is desperately needed to replace the antiquated, difficult to maintain, and expensive to operate radars in the current system, they still retain many of the same operational limitations. Ground based radars are limited to detecting only what is within their line-of-sight. Consequently, their ability to detect and track vehicles operating at low altitudes is limited both by the curvature of the earth, and by terrain masking. Soviet bombers, and especially cruise missiles operating at low altitudes, if flown along ingress routes designed to minimize their exposure to these radar sites, would be difficult to detect and almost impossible to track from ground based radar sites.

Recognizing this limitation, the ADMP also included the development and deployment of Over-the-Horizon Backscatter (OTH-B) radar sites to provide long range atmospheric surveillance. OTH-B radar differs from conventional radar in that it uses the ionosphere to reflect its radar signals and thus is not constrained by the line-of-sight restrictions of conventional radars. While it provides long range detection and tracking of aircraft, OTH-B has three limitations which may restrict its utility to CAD. First,

it is dependent on the ionosphere to bounce its signals. The ionosphere in the polar regions is very unstable, and is susceptible to disruptions caused by magnetic storms, solar activity, and Aurora Borealis activity. (19:61) Likewise, the sensitivity of the OTH-B system is yet to be determined. Whether or not it can detect small radar cross section targets such as cruise missiles is subject to some debate. Tests to determine its capability and reliability are currently being conducted. Finally, OTH-B radars have a minimum range which is a function of the reflectivity of the ionosphere in which their signal is propagating. Any targets within this minimum range (typically on the order of several hundred miles) will not be seen by the radar. (19:60) Several of the OTH-B sites are situated near the coasts of those parts of the country they are responsible for covering, consequently, their "blind" zone could be especially critical if the threat were SLCMs launched from submarines operating inside the minimum range of these radars. Conventional radar sites along the Canadian and U.S. coasts will have to be responsible for detecting this type of threat, and their constraints, as previously mentioned, will reduce the response time of the CAD system.

The airborne element of the surveillance network consists primarily of the E-3 AWACS aircraft, but does include several aerostats or balloons which carry radar systems. The aerostat systems are used primarily in the south-

ern U.S. as a means of detecting low flying aircraft associated with drug smuggling. At the moment they are not considered attractive systems for the CAD role because of their susceptibility to high winds and other adverse weather. Conversely, the E-3 AWACS is an extremely valuable resource for the CAD mission. The USAF possesses approximately 34 of these aircraft, and it is estimated that eight of these aircraft would be provided to NORAD for CAD in the event of heightened tensions or war. (19:61) AWACS is an outstanding system, and is a critical element in CAD. It can be used as a "gap-filler" surveillance asset when other elements of the surveillance network are degraded, but it has special utility because it can be sent far forward along expected ingress routes to provide early warning and tracking of intruders before any other element might detect them. This capability is particularly advantageous when combined with air refueling tanker support and an associated fighter force capable of intercepting, identifying, and destroying ingressing threats at great distances away from their targets. AWACS also has important command and control capabilities which will be discussed in greater detail later in this chapter. However, there are limitations associated with AWACS. Aircraft availability will be limited. There simply are not enough E-3s available to support all their worldwide commitments. Even if allocated the eight specified, this is not sufficient for NORAD to cover the

most likely ingress routes on a "round-the-clock" basis. AWACS assets are allocated by the JCS to the commands which have the greatest need. Based on the world situation, NORAD might not receive the number of E-3s it expects. Lastly, AWACS capability against cruise missiles is not necessarily equivalent to its capability against manned aircraft. The reduced radar cross section decreases detection range, and thus reduces the volume of air space the AWACS can be expected to cover in its surveillance role.

Finally, with the exception of the AWACS, the surveillance network was not designed to operate in a wartime environment. It has limited ability to counter ECM, the sites are not hardened to limit damage in the event of attack, there is little or no overlap between adjacent sites, and little redundancy within the system to compensate for losses after an attack.

It is important to appreciate the synergistic nature of the CAD surveillance network. Adroit management of these assets can compensate for some of their individual shortcomings. Nevertheless, the present and future surveillance networks, will still have some significant shortcomings. These include: limited ability to detect and warn of cruise missile attack; limited ability to detect and warn of low altitude threats; and very limited capability for the ground based segment to survive and operate in a wartime environment.

Weapon Systems

The current and proposed weapon systems for CAD consist of manned fighter interceptor aircraft only. No SAMs or AAA are currently or projected to be dedicated to CAD. The assigned interceptor force consists of approximately 340 fighters made up of F-4, F-106, F-15, F-16, and CF-18s. The ADMP directs the conversion of all the remaining F-106s and F-4s to F-16s within the next four years. The CAD interceptor force will also be augmented by additional fighter forces in the event of crisis or war, primarily from Tactical Air Command's general purpose forces assigned to training bases in the CONUS.

When the conversion to F-16s is completed, all CAD fighters will have weapon systems capable of "look-down" detection of low altitude targets, and will be significantly more capable of autonomous operations (i.e. less tied to the surveillance network for assistance in detecting and intercepting intruding aircraft). Of the aircraft available, the F-15 is by far the most capable. It has a powerful radar which enhances its ability to detect targets, especially cruise missiles, at longer ranges. It has a combat radius which allows it to conduct its operations either at greater range, or with more "loiter" time in their assigned areas than the other fighters. Its armament load is the largest, and the most capable. The CF-18 has a slightly less capable radar than the F-15, but carries only half the armament

load, and has significantly less range. The F-16 has a less powerful radar than either of the other fighters, and about the same range as the CF-18. However, it is the F-16's armament which currently most constrains its capability. Until such time as the aircraft is modified to carry either the AIM-7 Sparrow, or the AIM-120 AMRAAM radar guided air-to-air missiles, the F-16 can only carry the AIM-9 Sidewinder missile. While this is an exceptional weapon, especially in its all-aspect versions, it has no capability in adverse weather. Specifically, it requires a clear air mass for the seeker head to detect and track an infrared heat source. This is a serious limitation. The CAD network must be capable of operating around the clock, regardless of weather conditions. This limitation was recognized when the F-16 was chosen as the replacement interceptor for NORAD's older fighters, and as a part of this program, all air defense F-16s are to be retrofitted with all-weather, radar guided missiles by the time the conversion is completed in the early 1990s. However, in an era when defense funding will become increasingly constrained, this modification could fall victim to the budget cutter's axe. Until all the F-16s dedicated to the CAD mission are modified to carry radar missiles, this will remain a very serious deficiency. Finally, the capability of the F-16 radar to detect small radar cross section targets needs improvement. Until this weakness is corrected, the F-16 will not be effective

against cruise missile size targets unless under the direct control of a surveillance system, such as an AWACS, which is currently tracking the target. Operations in conjunction with either F-15s or CF-18s may be necessary until the F-16's shortcomings are corrected.

Another limitation which applies to all three of these aircraft is their lack of adequate range. While the F-15 (especially when equipped with conformal fuel tanks) has outstanding range for a fighter aircraft, the ranges and loiter times required to meet the needs of CAD makes aerial tanker support imperative both for the fighters and AWACS. It would not be an overstatement to say that CAD is critically dependent on air refueling. To further complicate the matter, the CF-18 requires "probe and drogue" refueling, while the other CAD aircraft use boom refueling. This becomes a problem because the bulk of USAF tankers are KC-135s which cannot be configured to refuel with both systems on the same mission. While the KC-10 can refuel using both systems, it is an even more scarce refueling asset. All these factors complicate the management of assets by the CAD commander, but the real issue is that sustained defense in depth is currently almost impossible without adequate tanker support. The ADMP addresses this limitation by calling for the establishment of forward operating bases (FOBs) in the Canadian and Alaskan Arctic regions which would allow interceptors to be forward based along the probable polar

ingress routes. This would permit them to conduct intercept operations against intruders while they are still at great distances from their targets, even if no tanker support were available. Likewise, Deployed Operating Bases (DOBs) are envisioned to facilitate AWACS operations in the Arctic. In short, the ADMP addresses the uncertainty of tanker support by opting for the use of these forward bases to put interceptors and AWACS aircraft closer to the threat so that defense in depth can still be provided. (2:39)

Command and Control

Like the surveillance network, the command and control system currently in place, and envisioned, was designed to operate in a peacetime environment. It was not designed for, nor is it likely to survive, any significant nuclear attack on the CONUS. With the exception of the Canadian NORAD Region's two SOCCs located underground at Canadian Forces Base (CFB) North Bay, all the remaining NORAD ROCCs and SOCCs are in "soft" locations. Likewise, communications are not hardened or of sufficient redundancy to ensure the continued command and control of forces in even the most benign post-attack environment. While the individual ROCCs have taken actions to equip and field survivable command elements to assume command after loss of the peacetime facilities, these are "ad hoc" efforts, and their utility and capability is still undetermined. On the other hand, the E-3 AWACS does have a significant command and control capa-

bility. All NORAD Regions plan to have a team of their personnel on any AWACS supporting their Region. One of their functions is to assume command if the Region commander is unable to exercise command from the ROCC. This alternate command capability will be limited both by the amount of time the E-3 will be able to remain airborne, and the ability of the personnel on board the AWACS to retain situational awareness of the ongoing situation.

The CAD command and control network now in place, and planned for in the ADMP, has not been designed to survive in a wartime environment. Likewise, the survivability of the other CAD elements is equally dubious. To survive an attack and reconstitute itself the CAD network must be able to: receive sufficient warning of an attack to launch its airborne elements; disperse its flying forces to orbit locations where they safe from collateral damage; and recover its forces at dispersed airfields which are undamaged and equipped with sufficient facilities to regenerate them (3:v) The surveillance network must be sufficiently robust that it still has reasonable capability to detect and track ingressing hostile aircraft. The C3 network must survive sufficiently that the region or sector commanders can continue to monitor and direct the activities of their units. It is this ability to continue to defend the CONUS from follow on attacks which is totally lacking in the current and future systems. If the Soviets were to attack, and our CAD

was unable to reconstitute itself, the initiative and advantage would pass to the Soviets by default. (18:42)

Summary

Both the current and modernized CAD have limited capability to warn of a cruise missile attack launched from over the polar routes, or from subs located inside the minimum range of the OTH-B systems. The current and planned interceptor force is heavily dependent on airborne tanker support, and the F-16 currently has some munitions and radar limitations. The entire network has little or no capability to survive and reconstitute itself after an initial nuclear attack of any magnitude. Thus, even without a change to America's defense strategy, (i.e. reliance solely on offensive forces for deterrence) these deficiencies, coupled with the Soviet threat previously discussed, highlight the critical need to improve the CAD network even beyond the improvements recommended in the ADMP.

CHAPTER V

IMPLICATIONS OF THE STRATEGIC DEFENSE INITIATIVE

In his famous "Star Wars" speech of March 23, 1983 President Reagan directed a national effort to define a long term research and development program for a system which would defend the United States from attack by ballistic missiles. (24:235-237) This was the genesis of the Strategic Defense Initiative (SDI). The purpose of this chapter is to evaluate the implications that SDI would have on CAD, and to illustrate the inextricable relationship that must exist between them. Ultimately, the national decision on the size and scope of SDI will have a significant effect on the size, capability, and perhaps even the existence of CAD.

Options for Deterrence

President Reagan's speech was, at the very least, evidence of a willingness to evaluate alternative means of achieving deterrence other than offensive retaliation. Should the United States decide to deploy an SDI system it would be the most fundamental reversal of American security strategy since the end of World War II. It would be a rejection of offensive retaliation and an adoption of a reliance on defensive forces to defeat a hostile force before it could significantly harm the country. While the President's speech appropriately concentrated only on the ballistic mis-

sile threat to the U.S., it is obvious that for a defensive deterrent strategy to be effective, <u>all</u> significant strategic nuclear delivery systems will have to be countered.

Interdependence of SDI and CAD

If the decision is made to proceed to the deployment of a SDI system, and there is no associated strategic arms reduction, it would seem inevitable that the Soviets would attempt to develop and deploy other strategic systems which would either be invulnerable to the SDI system, or be able to operate within it at an acceptable attrition rate. Clearly, one of the attractive alternatives would be air breathing vehicles, especially if the U.S. does not take significant action to revitalize its air defense network. In short, a decision to build a ballistic missile defense will require an equally firm commitment to enhance CAD. Similarly, if it is technically or fiscally impossible to build a credible CAD, it would make no sense to proceed with deployment of the SDI system. There is no purpose in being able to defend against ballistic missiles and not be able to defend against airbreathing vehicles. This is precisely the same logic which allowed the air defense system to wither and almost disappear since the early 1960s, i.e. it made no sense to build and maintain a system to defend against bombers when we were unable to defend against missiles. The logic of the 1960s is still valid in the 1990s.

It is important to understand that in all likelihood SDI will have little or no inherent capability to perform the CAD mission. Its warning sensors will be designed to detect and track ballistic missiles not aircraft. The phenomenology associated with the launch and flight of a ballistic missile is very different from that associated with an airbreathing vehicle. During its launch and boost phase a ballistic missile generates a large, intense exhaust plume which can be detected by infrared sensors. Likewise, as it passes through the ionosphere it leaves a long wake of ionized particles behind it. Conversely, air breathing vehicles leave relatively minuscule signatures, and are therefore, much more difficult to detect. Furthermore, once boost phase has been completed, a ballistic missile essentially remains on predictable flight path which facilitates the calculation of intercept geometry and employment of weapons against it. Quite a different situation exists for vehicles operating within the atmosphere. They can be maneuvered at any time, and can only be reliably intercepted if they are tracked continuously up to the point of intercept. Finally, and most importantly, the weapons which are most attractive for SDI requirements will probably not be applicable for use in CAD. The most likely SDI weapons are designed to operate in the vacuum of space against targets passing through that same medium. A weapon employed in the CAD role must be capable of destroying a vehicle operating

within the atmosphere. This mitigates against space based weapons such as lasers, directed energy weapons, and particle beam weapons because their energy is attenuated and diffracted when it passes through the atmosphere.

There are three notable exceptions to the apparent lack of commonality between the requirements for SDI and CAD. First, the battle management functions which are developed to support SDI could have application to CAD. Second, those SDI weapons which are ground based and have a terminal point defense mission may also be suited for performing atmospheric defense. These systems must be able to detect, track, engage, and destroy missile warheads as they reenter the atmosphere, moments before impact. The kill mechanism of such a system might be effective against airbreathing vehicles as well. And thirdly, if CAD were to become heavily dependent on space based systems, then the defensive measures being investigated by the SDI to defend their space assets may also be applicable.

Using this same logic, if and when a decision is made to deploy a SDI system, the size, scope, and capability of that system may be the decisive factor in sizing the extent and capability of an associated CAD system. If an "all out", 99 and 44/100th percent effective SDI system is to be deployed to protect the entire CONUS, then a similarly capable network must also be built for CAD. Conversely, if an SDI system is built, designed only to defend a specific geo-

graphic section, or sections, of the CONUS (i.e. strategic retaliatory bases, or command and control nodes for example) then the associated CAD upgrade need only be commensurate with it.

To summarize, the need for a revitalized CAD is closely, but not totally, linked to the fate of SDI. Other than to provide reliable warning of an atmospheric attack on North America and to ensure air sovereignty of the nation's boundaries, there is little need to improve CAD beyond the modernizations specified in the ADMP unless some form of SDI is deployed, or the nature of the Soviet threat changes dramatically. In the next chapter, impending technological advances which could potentially change the nature and capability of strategic air threats will be discussed.

CHAPTER VI

OTHER TECHNOLOGICAL BREAKTHROUGHS

There are a number of areas ripe for technology breakthroughs which could have significant impact on CAD. Some of these breakthroughs could facilitate CAD, while others could complicate it, and some may do both. The most likely areas for rapid advancement include: the development of "stealth" aircraft which have significantly reduced radar signatures; continued improvements in efficiency and size reduction of jet engines, enhancements in jet fuels, and advances in aeronautical design which would improve aircraft performance; improvements in the accuracy and lethality of conventional weapons; the development of sensors for the detection and tracking of aircraft from space; and finally, the technology which grows out of the Air Defense Initiative (ADI) program.

ADI

While the sensors and weapons associated with the SDI program may not be directly applicable, technologies developed by that program may yield important benefits to CAD through a new program known as the Air Defense Initiative. Little information is available from unclassified sources about ADI, but it is not believed to be a part of the SDI effort. According to Brig Gen Robert Rankin, the program

director, ADI examines technologies the already exist within all the services and evaluates their applicability to the air defense mission. (27:10) Whether this effort is focused only on the CAD mission, or also includes efforts to enhance air defense at the theater level is still not clear. It should be noted that the air defense problem within a theater may be quite different from that confronted by CAD. For example, the European theater commander is faced with a far greater number of hostile aircraft all in relative close proximity to their most likely targets, thus he does not have the luxury of early warning to posture his force, nor can he "defend in depth" in the same manner as the CAD commander can. Naturally, there are some elements of the air defense problem which are similar for both the CAD and theater commander, but overall the two air defense situations are not exact duplicates, and therefore their solutions may not be identical either.

Stealth

There has been much speculation in the media about the development of "stealth" aircraft by the United States. It would seem reasonable to assume that a similar program is in progress within the Soviet Union. The impact of such an aircraft would be to render obsolescent the radar sensors upon which virtually every air defense system of the world, both friendly and unfriendly, is based. Such a breakthrough may require development of sensors, either active or pas-

sive, which would rely on completely different phenomenology elsewhere in the electromagnetic spectrum to detect and track "stealth" aircraft. Prudence demands that the research and development community devote considerable effort to counter this threat. Failure to do so will have significant, and perhaps decisive impact not only on CAD, but on air superiority operations in theaters around the world. It is difficult to fully appreciate the profound impact a practically "invisible" aircraft would have on both reconnaissance and strike operations. For example, a true "stealth" platform would be able to conduct reconnaissance without an adversary even being aware of its presence or activities. Such a capability would have utility in peacetime and war, and would eliminate many of the intrinsic shortcomings associated with satellite reconnaissance vehicles such as predictability, lack of flexibility, and delayed responsiveness. It is a simple matter for an adversary to know when, and from what direction, a reconnaissance satellite will pass over his location, therefore it is relatively simple for him to prepare deception and concealment measures to negate the satellite threat. Conversely, a "stealthy" vehicle operating within the atmosphere does not fly a predictable flight path, and thus an enemy force is always vulnerable to its surveillance. Likewise, a "stealthy" bomber would be an ideal weapon system to use for a surprise attack on an adversary, and thus would be ex-

tremely attractive to the Soviets if they were planning to execute the decapitation scenarios mentioned in Chapter III.

Performance Enhancements

Improvements in the area of efficiency of aeronautical design, propulsion, and fuels could result in improved atmospheric vehicles capable of greater range, speed, or payload. Such performance enhancements would have implications for forces on both sides of the equation. A Soviet bomber or cruise missile capable of long duration flight at supersonic speeds would reduce a defender's response time and present a far more difficult intercept and destruction problem for CAD forces. Conversely, an air defense network equipped with interceptor aircraft with supersonic cruise capability would accrue marked advantage over subsonic intruders by improving its response time, capability to defend in depth, and ability to engage more targets in less time.

Likewise, improvements to aircraft range would benefit both sides of the conflict. The development of cruise missiles with sufficient range to be launched outside of the coverage of CAD sensors, the Soviet Arctic for example, would put further pressure on the CAD system which currently predicates its defensive strategy against cruise missiles on cueing information to find and destroy the cruise missile carriers. (42:209) Conversely, the development of such fuels would certainly reduce the present critical dependence CAD aircraft have on air refueling support.

Non-Nuclear Strategic Weapons

Another area where potential breakthroughs could have profound impact is in the area of non-nuclear strategic weapons (NNSW). It is possible by the end of this century that NNSWs may be capable of achieving destruction of strategic targets within an adversary's homeland. Improvements in guidance systems are yielding accuracy of weapons delivery never before thought possible. Munitions developments are resulting in warheads using conventional chemical high explosives which are capable of channeling their energy in ways which optimize their effectiveness against a specific type of target. (34:1) And, as we have already discussed, improvements in delivery systems such as improved range, speed, and payload coupled with reduced signature may allow for extremely lethal conventional munitions to be delivered with great accuracy at intercontinental ranges with little risk of being detected or negated prior to striking their target. The ability to destroy an enemy's strategic targets within his homeland without crossing the nuclear threshold could completely change the preconceptions many have about the nature and duration of the next war. (34:2)

Space Based Surveillance

Finally, development of a "space based" sensor system would have significant benefit for CAD. Such a system, if reliable, capable, and of sufficient quantity, would greatly reduce many of the vulnerabilities discussed in

Chapter III regarding sensor limitations. As an interesting spin-off, a radar operating in space, above a "stealth" vehicle, may not be as affected by its characteristics because of the unique and extreme overhead aspect the sensor would have of the vehicle. A vehicle may be optimized to be very "stealthy" from certain aspects by virtue of its design, but may not be "stealthy" at all from other aspects the designers did not consider a viable threat, such as directly overhead. Similarly, a space based radar (SBR) would also reduce or eliminate the difficulty associated with detecting and tracking aircraft operating at low altitudes, again because of its unique perspective of the threat. SBR would, of course, also have enormous utility for a theater CINC just as it would for the CAD commander. It should be pointed out that any space based system has unique vulnerabilities along with their unique capabilities. They are very susceptible to numerous forms of negation, particularly if they are in low-earth orbit. Consequently, their ability to survive after the outbreak of war is dubious, in which case, a commander would still need some other form of surveillance robust enough to survive and operate effectively in the wartime environment.

Summary

In summary, all these areas are ripe for technology breakthroughs which could have significant effects on the nature of warfare, and specifically on CAD. The United

States must continue to conduct research and development in these areas and, if necessary, take the required steps to either counter these new technologies, or exploit them to enhance the capability of the CAD system. Another area which could determine the future requirement for CAD, and SDI for that matter, is the arms control and reduction negotiations. Chapter VII will examine this area in greater detail.

CHAPTER VII

IMPLICATIONS OF ARMS CONTROL

Direct Implications

Recent efforts by the political leaders of the United States and the Soviet Union to seek a negotiated reduction in arms, particularly nuclear weapons, have gained much momentum. These negotiations may have both direct and indirect impact on U.S. military strategy in general and CAD in particular. The direct implications are obvious, hinging on the choice of weapons to be constrained, and the limitations to be placed on them. Such constraints will be critical factors in determining the size and capability of the future CAD force. Clearly, if cruise missiles are eliminated as a class, then the requirement for a CAD to counter such a threat diminishes. Likewise, if strategic ballistic missiles are reduced or eliminated, but air breathing strategic delivery systems are not similarly constrained, then the requirement for an effective air defense increases.

Indirect Implications

Less obvious, but equally important are the indirect implications of arms control and limitations thereof. Agreements such as the Intermediate Nuclear Forces (INF) Treaty could place greater reliance on nuclear weapon

systems which are based outside of Europe to provide the forces necessary for the "flexible response" on which NATO deterrent strategy is based. Therefore, CAD may become increasingly important as a means of protecting those elements of the U.S. Triad which serve an additional role as theater nuclear forces for NATO. Similarly, both the United States and the Soviet Union can be expected to place increased emphasis on those weapons which are not constrained by arms control agreements. Weapons which may not constrained, such as the ALCM and SLCM, could become more attractive to war planners. This could result in increased production of these vehicles and greater efforts to improving their capabilities. A CAD network tasked to detect and destroy vehicles of this type could then be confronted with a sudden leap in quantity or quality of these types on weapons as a direct result of arms limitation agreements in a completely different theater. In short, arms limitations at the theater level could result in an arms race at the strategic level, further complicating the CAD problem.

One other indirect effect of arms control should be mentioned. That is, the insidious affects the euphoria surrounding such agreements can have on the American people, even before negotiations are completed. Once the perception exists that arms control is "at hand", many people in this country tend to assume it is "fait accompli", and are therefore predisposed against any further outlays for defense

against these weapons. In their minds the threat either no longer exists, or will soon disappear. In short, they become victims of their own optimism, and ignore the possibility that these negotiations may not be concluded in the near term as they believe. The consequence of this perception is that as negotiations drag on, we may become weaker vis a vis our adversary, and thus he may feel less compelled to complete such an agreement. In short, the prospects for successful conclusion of an arms control treaty may be reduced by our reluctance to continue to move ahead on defense programs until such time as these negotiations are completed.

Confidence Building Measures

Another area which may impact the requirements for CAD and where diplomatic progress is being explored is in an arena known as "confidence building measures" or CBMs. These are negotiated procedures designed to reduce the tension between the superpowers both during peacetime, and more importantly during periods of increased tensions. CBMs are meant to reduce the threat of an "accidental" war between the superpowers, and to prevent the miscalculation or misunderstanding of an opponents actions which could further exacerbate the tensions already present between the principle adversaries during a crisis. Such miscalculation might well lead to the very condition both countries would presumably be trying to avoid, the increasing risk of nuclear war. CBMs might include restricting the testing, basing, or

training of strategic forces from locations where they could threaten an opponent's homeland. For example, a mutual agreement to prohibit training flights by strategic bombers south of the North Pole into the opponent's hemisphere, or removal of cruise missile carrying submarines from patrol areas where their SLCMs could reach the homeland of the opponent. Such measures, if and when implemented, could impact the weapons, strategies, and postures of the strategic offensive and defensive forces of both nations, and thus have ramifications for CAD. (7:11)

Effects of CAD on Arms Negotiations

Finally, the impact that an effective CAD may have on arms control should not be discounted. By building an effective strategic defense, or at least demonstrating a capability and willingness to do so, using both SDI and an improved CAD, the U.S. could make the cost of constructing new offensive weapons so unattractive that the Soviets might become more inclined to negotiate further reductions in strategic nuclear weapons. This impulse could become even more pronounced if our arms control proposals were posed in such a manner that they would make the Soviets feel more secure. This might be done by proposals which further reduced or eliminated certain types of offensive weapons. Likewise, a proposal which would share, or allow Soviet participation in, strategic defensive systems would have the same effect, but would have to be carefully considered before being

offered as an inducement to them. (29:51) In conclusion, an improved CAD system and SDI program are not at cross purposes with America's desire for arms control. Quite the contrary, they are powerful motivators for the Soviets to rapidly conclude such agreements.

Summary

It would be foolhardy to try and predict the outcome of negotiations of this nature between the United States and the Soviets. But it is clear that both sides are at least talking and considering such agreements. However, the prudent course for the U.S. would be to continue to pursue research and development of new weapons and surveillance technologies to improve our present CAD network until the outcome and ramifications of these agreements are clearly understood. The ultimate decision on whether or not to deploy highly capable strategic defense systems such as SDI and an improved CAD will have to be made in the context of the country's national security strategy at the time of the decision. Without question, one of the most critical factors in the deployment decision of either the SDI system or an improved CAD will be the outcome of these arms control negotiations.

CHAPTER VIII

LONG AND SHORT TERM RECOMMENDATIONS

The proceeding chapters have attempted to establish reasonable and persuasive requirements for revitalizing America's CAD network. With that as an assumption and fully cognizant of the fiscal realities which will constrain defense spending by the United States during the next decade, what steps should be taken to meet these requirements? This chapter presents recommendations structured to answer that question both in the "short term" prior to the end of the century, and in the "long term" after the year 2000.

Short Term Recommendations

This country will require at least some minimum level of CAD regardless of the fate of SDI and arms control negotiations. However, because outcomes on both these subjects remain uncertain, it would be senseless to commit massive funding to significantly upgrade CAD in the short term. Accordingly, until decisions on deploying SDI are made, improvements agreed to in the ADMP should continue to be acquired, low cost survivability enhancements should be implemented, and research and development associated with the ADI program should be pursued. The specific details of these short term recommendations are described below.

The construction of OTH-B radar sites to cover the

coastal and southern approaches to the CONUS should be completed. If necessary, enhancements to assure the detectability of cruise missile size targets must be acquired. The NWS to cover the northern approaches, should also be completed. Replacement of older generation interceptors must be accomplished without delay. The F-16s assigned to the CAD role must be retrofitted with the capability to employ all-weather radar missiles at the earliest possible time. The FOBs and DOBs specified in the ADMF to forward base the interceptors and AWACS aircraft in the northern regions of Canada and Alaska should be accomplished as soon as possible. Once these bases are declared operational, they and the forces assigned to them, must be exercised regularly and under all seasonal conditions so that CAD forces are fully prepared to deploy and carry on sustained operations in the Arctic environment.

Institutionally, NORAD must strive to insure that it will receive adequate priority from the Joint Chiefs of Staff (JCS) for AWACS and tanker resources so that it will receive the forces it must have. The efficacy of its campaign strategy and operational plans is a direct function of the accuracy of its assumptions about the threat and the forces available to counter it. Plans which are based on forces that cannot reasonably be expected to be made available will be of little use when the time comes to execute them.

Likewise, shortfalls in CAD capability must be realistically confronted. CAD leadership must address these issues and extract the maximum possible capability from the forces at hand. Training programs need to be reviewed for currency and, if necessary, revised to tailor the capabilities of CAD forces to the mission they are expected to perform. Increased emphasis on survival and reconstitution of forces is needed. Dispersal airfields should be established with adequate maintenance, fuel, and munitions capability (including personnel) so that CAD aircraft would not be solely dependent on their home bases or deployed locations to continue operations following an attack. The attitude that CAD has no role in the post-attack phase must be eradicated. The CAD system must plan to survive, reconstitute, and provide organized resistance to follow-on attacks. Finally, CAD forces need to improve their awareness, understanding, and practise of effective cover, concealment and deception measures to enhance their survivability and effectiveness in a wartime environment. (18:x)

Long Term Recommendations

For the long term, the ultimate fate of the SDI program and the results of arms control negotiations will have dramatic impact on the size and capability of the CAD system. If the decision is made not to ceploy SDI, then the CAD network recommended for the short term and periodically upgraded commensurate with the threat should be adequate.

Improvements for such a system would probably be limited to the development and acquisition of sensors solely for the attack warning function, which must be capable of effectively and reliably detecting improved cruise missiles and "stealthy" targets.

However, if the decision is made to deploy an SDI network, then a commensurate CAD network will also be necessary. Application of technologies derived from the SDI program should be deployed as appropriate, specifically: ground based, point defense weapons; survivable space based surveillance sensors capable of detecting and tracking all threats; and robust C3 battle management systems. Likewise, as the Advanced Tactical Fighter (ATF) begins to replace today's front line fighters, especially the F-14D and F-15C, they, in turn, should be used to replace air defense dedicated F-16s because of their superior range, firepower, and detection capability. At the same time, the requirements for an effective CAD interceptor should be included in the design specifications of the ATF, or its replacement. Some of these requirements might include: short-takeoff-and-landing (STOL) capability to enhance its ability to operate from damaged runways or austere locations; a fire control system that can choose between active and passive detection phenomenology; the ability to "tie-in" to data from an external sources such as airborne or space-based sensors via some form of data-link; carriage of

"launch and leave" air-to-air missiles capable of long range engagements against the whole spectrum of threats and countermeasures; and the capability to loiter for long periods of time, along with the ability to cruise at supersonic speeds, and if necessary, to dash at speeds in excess of 1.2 times the maximum speed of any foreseeable atmospheric threat. (37:2-28) Finally, the feasibility of ultra-long range SAMs guided by SBRs should also be examined. These items constitute the elements of a CAD system designed to operate in conjunction with a fully deployed SDI network in the 21st century.

CHAPTER IX

SUMMARY AND CONCLUSIONS

The ability of the United States to defend itself from air attack has steadily decayed over the past quarter of a century. Arguably, the strategic situation which existed in the early 1960s justified the national decision to rely totally on offensive retaliation and reject strategic defense as a means of deterring war with the Soviet Union. However, as this country prepares to enter the final decade of the Twentieth Century, the strategic situation has changed sufficiently that the continued disregard of continental air defense subjects this country, and its allies, to significant vulnerabilities. The dramatic growth in the quality and quantity of Soviet bombers and cruise missiles since 1980, now exposes the U.S. to the threat of a surprise attack for which it might receive no warning until nuclear warheads were detonating over their American targets. This threat makes it imperative that the U.S. complete the modifications to the continental air defense system called for by the ADMP, and that it take whatever steps are necessary to assure itself of adequate and reliable warning of an air attack on North America.

At the same time other factors, such as reduced defense budgets, progress in arms control negotiations, and

the emergence of new technologies such as SDI and "stealth" will have significant impact on our national strategy entering the Twenty First Century. It is clear that the national leadership is beginning to seriously question the premise of deterrence based solely on offensive retaliation. It appears to be considering a more balanced mix of strategic offensive and defensive capabilities to deter war. This revision of national strategy could lead to greater reliance on strategic defense to protect the United States and its allies from the threat of nuclear war. Ultimately, the feasibility of the SDI program, and the results of arms control negotiations will have a decisive impact on our future national strategy. The revitalization of continental air defense will have to be an essential element if such fundamental changes to our national strategy occur. For the long term, the U.S. should continue research and development associated with the ADI program so that it is prepared to implement the actions necessary to reconstitute our national deterrent strategy to a more defensive orientation.

A decision to adopt a more defensive strategy for deterrence may be expensive. Yet, such decisions illustrate the most fundamental question associated with all defense expenditures: how much do we need to spend to preserve peace, freedom, and the way of life of our country and our allies? There is no simple answer. All such decisions involve an evaluation of risk. A decision not to expend

adequate funds on defense risks our national survival. In the final analysis, that is a risk the United States, and all the nations of the Free World, cannot afford to accept.

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GLOSSARY OF ABBREVIATIONS

AAA	Antiaircraft Artillery
ADI	Air Defense Initiative
ADMP	Air Defense Master Plan
ALCM	Air Launched Cruise Missile
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANR	Alaskan NORAD Region
AOR	Area of Responsibility
ASM	Air-to-Surface Missile
ATF	Advanced Tactical Fighter
AWACS	Airborne Warning and Control System
CAD	Continental Air Defense
CBM	Confidence Building Measure
CFB	Canadian Forces Base
CINC	Commander-in-Chief
CNR	Canadian NORAD Region
CONUS	Continental United States
CONUSNR	CONUS NORAD Region
C3	Command, Control, and Communications
DOB	Deployed Operating Base
DoD	Department of Defense
ECM	Electronic Counter Measures
FOB	Forward Operating Base
ICBM	Intercontinental Ballistic Missile
LRR	Long Range Radar
INF	Intermediate Nuclear Forces
JCS	Joint Chiefs of Staff
JSS	Joint Surveillance System
MAD	Mutual Assured Destruction
NCMC	NORAD Cheyenne Mountain Complex
NORAD	North American Aerospace Defense Command
NWS	North Warning System
OTH-B	Over the Horizon, Backscatter
ROCC	Region Operations Control Center
SAM	Surface-to-Air Missile
SBR	Space Based Radar
SDI	Strategic Defense Initiative
SLBM	Submarine Launched Ballistic Missile
SLCM	Sea Launched Cruise Missile
SOCC	Sector Operations Control Center
SRR	Short Range Radar
STOL	Short Take Off and Landing
USAF	United States Air Force